

87009

(19)



JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: **07144636 A**

(43) Date of publication of application: **06.06.95**

(51) Int. Cl. **B60T 13/74**
F16D 65/18

(21) Application number: **05291770**

(22) Date of filing: **22.11.93**

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(54) MOTOR-DRIVEN BRAKE DEVICE

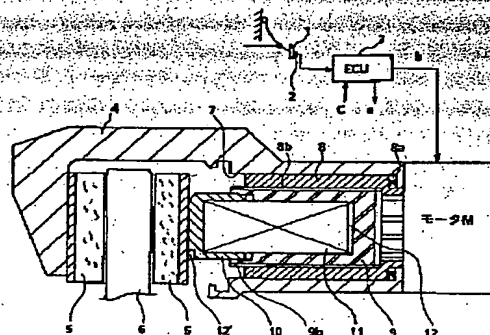
(57) Abstract:

PURPOSE: To operate a brake by the driving force of a motor in case of the low load and large stroke in the initial operation of the brake, and to obtain a prescribed brake force by a piezoelectric element in case of the high load and small stroke during the brake operation.

CONSTITUTION: When a brake pedal 1 is stepped-ON, the stepping force at this time is detected by a stepping force sensor 2, and a motor M is driven by an electronic controller 3, and a rotary member 8 is revolved. The first piston 9 is shifted leftward on the figure through a screw mechanism by the revolution of the rotary member 8, and a disc pad 5 is pressed on a disc 6, and brake is applied. When the pressing force applied to the disc 6 by the disc pad 5 becomes over a prescribed value, the pressure at this time is detected by a pressure sensor 12, and the operation of the motor M is suspended, and a piezoelectric element 11 is applied with an applied voltage, and the pressing force of the disc pad 5 is increased by the piezoelectric element 11, and the remarkably strong brake force is

applied on the rotor 6.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] About an electric operation brake gear, further, in a detail, this invention divides the operating mode of a brake into two stages of a low load large stroke portion and a high load smallness stroke portion, operates a brake by the small motor at the time of a low load large stroke, adopts at it the mechanism which operates a brake by the piezoelectric device at the time of a high load smallness stroke, and relates to the electric operation brake gear which can attain small lightweight-ization.

[0002]

[Description of the Prior Art] In recent years, apart from the brake operation circuit by oil pressure, development of the electric operation brake gear (the so-called brake motorcycle wire method) which operates a brake with an electrical signal is furthered. an electric operation brake gear -- brake ** -- construction of a system is easy, when the feature is in the point which can make the whole system small lightweight as compared with the brake gear of the conventional hydraulic-circuit formula and various control (**, such as an antiskid control, traction control, and automatic-braking-system control) of a brake gear is performed further, in order to change dull treading strength into an electrical signal and to operate a brake gear with the signal from an electronic control -- etc. -- there is an advantage.

[0003] What incorporates a parking brake in an electric operation brake, and can mitigate the operation burden of a parking brake is indicated by JP,4-108058,A as an example of equipment conventionally [aforementioned]. This brake gear forms the vehicles state detector which distinguishes the stop state and run state of vehicles, controls the energization to the aforementioned electrical motor based on the output signal of this vehicles state detector, and enables it to use it as a parking brake while it establishes the irreversible mechanism in which only the power transfer to a brake mechanism from an electric actuator is permitted, between an electric actuator and a brake gear. However, in this brake gear, the mechanism which carries out power transfer to a brake gear from an electric actuator becomes complicated. Moreover, since a brake operating mode cannot be made into two stages, a problem is in the responsibility at the time of the initial operation of a brake.

[0004]

[Problem(s) to be Solved by the Invention] Then, this invention transmits the driving force of a motor to a direct brake gear through a screw mechanism at the time of the low load large stroke at the time of the initial operation of a brake, and operates a brake. By proposing the brake operation system which can obtain a predetermined brake force by the piezoelectric device at the time of the high load smallness stroke under brake operation, and including this operation system in a brake caliper It is good, composition is simplified and responsibility uses as a proposal plug the new electric operation brake gear which can attain small lightweight-ization of equipment.

[0005]

[Means for Solving the Problem] For this reason, the cylinder 7 in which the electric operation brake gear of this invention was formed in the caliper 4 of a brake gear, the rotation arranged in this cylinder 7 -- a member 8 and this rotation -- with the motor M which gives turning effort to a member 8 this rotation -- with the pistons 9 and 10 which move the disk pad 5 towards Rota 6 by rotation of a member 8 It is arranged in the aforementioned piston, is characterized by having the

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piezoelectric device 11 which turns and moves the aforementioned disk pad 5 to Rota 6, and the aforementioned motor M and the electronic control 3 which controls the aforementioned piezoelectric device 11, and let this be the means of technical-problem solution.

[0006]

[Function] [the time of the initial operation of a brake, i.e., a low load large stroke,] -- an operator -- brake ** -- dull -- if 1 is stepped on, the treading strength at this time will detect by the treading strength sensor 2 -- having -- an electronic control 3 -- an input signal -- responding -- Motor M -- driving -- rotation -- a member 8 is rotated rotation -- by rotation of a member 8, the 1st piston 9 moves to the left in drawing through a screw mechanism, the disk pad 5 is pushed against a disk 6, and brakes are applied

[0007] The [time of a brake operation, i.e., a high load smallness stroke,] The brake begins to work. The voltage at this time is detected as the press force to the disk 6 with the disk pad 5 becoming beyond a predetermined value by the pressure sensor 12. While suspending the operation of Motor M, applied voltage is supplied to a piezoelectric device 11, a piezoelectric device 11 is expanded, the press force of the disk pad 5 is heightened through the 2nd piston 10, and a stronger brake force is given to Rota 6.

[0008] The [time of brake being loose] A brake is loosened, the voltage at this time is detected as the press force to the disk 6 with the disk pad 5 becoming below a predetermined value by the pressure sensor 12, a terminal twist is inputted into an electronic control 3, and while stopping supply of the applied voltage to a piezoelectric device 11, a brake force is controlled to reverse Motor M and to become the then required necessary press force.

[0009]

[Example] Hereafter, the example of this invention is explained based on a drawing. Drawing 1 is the cross section of the electric operation brake gear concerning the example of this invention incorporated in the caliper. In drawing, 1 is Rota where a brake caliper and 5 had been arranged at two disk pads, and 6 has been arranged [a brake pedal and 2 / a treading strength sensor and 3] for an electronic control (ECU) and 4 between the aforementioned disk pads, each composition is using the well-known thing and explanation of those detailed composition is omitted.

[0010] the rotation which the cylinder 7 is formed in the aforementioned caliper 4, and carried out the cylindrical shape into this cylinder 7 -- a member 8 is formed possible [rotation] -- having -- rotation -- thrust ** ARINGU 8a is arranged between the member 8 and the pars basilaris ossis occipitalis of a cylinder 7 rotation -- a member 8 is connected with the output shaft 16 of a motor through the gear mechanism 15, as shown in drawing 2 and drawing 3 -- having -- **** -- the turning effort of Motor M -- rotation -- it is transmitted to a member 8 for this reason -- if Motor M rotates -- the gear mechanism 15 -- minding -- rotation -- a member 8 is also rotated

[0011] rotation -- male screw 9b which the 1st piston 9 which carried out the cylindrical shape is arranged inside the member 8, and was formed in the periphery of this 1st piston 9, and rotation -- female screw 8b formed in the inner skin of a member 8 has geared The 2nd piston 10 has fitted into the edge by the side of the disk pad of the 1st piston 9 of the above free [sliding of piston shaft orientations]. The 2nd piston 10 is attached so that it may not drop out of the 1st piston 9 with the stopper which is not illustrated. The disk pad 5 is attached in the edge of the 2nd piston 10, and between the 1st piston 9 of the above, and the 2nd piston, as a piezoelectric device 11 and a pressure sensor 12 show drawing 1 and drawing 4, it is prepared. The aforementioned disk pad 5 and each pistons 9 and 10 cannot be rotated.

[0012] The press force to Rota 6 with the disk pad 5 is detected by the aforementioned pressure sensor 12. The signal from the aforementioned pressure sensor 12 and the treading strength sensor 2 is transmitted to an electronic control 3, as shown in drawing 4, and it controls Motor M or a piezoelectric device 11 by the electronic control 3 based on these signals.

[0013] The operation of the electric operation brake gear concerning the above-mentioned composition is explained.

The [time of the initial operation of a brake, i.e., a low load large stroke,] Before the brake operation, since there are no instructions from an electronic control 3, this brake gear is in the state of drawing 1, and it is separated [from it] of the disk pad 5 and Rota 6. an operator -- brake ** -- dull -- if 1 is stepped on, the treading strength at this time will be detected by the treading strength sensor 2, and

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will be inputted into an electronic control 3 an electronic control 3 -- an input signal -- responding -- Motor M -- driving -- the gear mechanism 15 -- minding -- rotation -- a member 8 is rotated rotation -- by rotation of a member 8, the 1st piston 9 moves to the left in drawing through a screw mechanism, the 2nd piston and the disk pad 5 also move in connection with this, the disk pad 5 is pushed against a disk 6, and brakes are applied

[0014] The [time of a brake operation, i.e., a high load smallness stroke,] If the brake begins to work and the press force to the disk 6 with the disk pad 5 becomes a predetermined value, the voltage at this time will be detected by the pressure sensor 12 arranged in a piston, and it will input into an electronic control 3 from c terminal. In an electronic control 3, while suspending the operation of the aforementioned motor M based on the signal from the aforementioned pressure sensor 12, applied voltage is supplied to a piezoelectric device 11. If applied voltage acts on a piezoelectric device 11, a piezoelectric device 11 will expand and will move the 2nd piston 10 to the left in drawing. By movement of the 2nd piston 10, the press force of the disk pad 5 is heightened and a stronger brake force is given to Rota 6. The signal from a pressure sensor 12 performs control of a brake force by controlling the applied voltage supplied to a piezoelectric device 11 with an electronic control.

[0015] The [time of brake being loose] A brake is loosened, the voltage at this time is detected as the press force to the disk 6 with the disk pad 5 becoming below a predetermined value by the pressure sensor 12, and c terminal twist is inputted into an electronic control 3. Supply of the applied voltage to a piezoelectric device 11 is stopped, and a brake force is controlled by the electronic control 3 to reverse the aforementioned motor M and to become the then required necessary press force.

[0016] in addition, the instructions for which an electronic control rotates reversely Motor M with the signal from the treading strength sensor 2 at the time of brake ** dull opening -- taking out -- the gear mechanism 15 -- minding -- rotation -- a member 8 is reversed, the 1st piston 9 and the 2nd piston 10 are moved to the method of drawing Nakamigi, and a brake is opened

[0017] As mentioned above, in this invention, at the time of the low load large stroke at the time of the initial operation of a brake, transmit the driving force of a motor to a direct brake gear through a screw mechanism, and a brake is operated. Since two step controls which can obtain a predetermined brake force by the piezoelectric device are performed at the time of the high load smallness stroke under brake operation, while being able to raise the responsibility of a brake operation Since it became possible to use the small motor M, small lightweight-ization of equipment can be attained.

[0018] In addition, in the above-mentioned example, although the pressure sensor 12 and the piezoelectric device 11 are contained between the 1st piston 9 and the 2nd piston 10, you may attach pressure-sensor 12' between the 2nd piston 10 and the disk pad 5 (refer to drawing 1). Furthermore, the load applied to Motor M, without using the aforementioned pressure sensor 12 can be detected, and a piezoelectric device 18 can also be controlled like ****. Moreover, in this invention, since pressurization of a brake force, maintenance, and reduced pressure can also be performed in an electronic control with the signal from the speed sensor which is not illustrated, an antiskid control and traction control can also be performed.

[0019]

[Effect of the Invention] As stated to the detail above, this invention combines a motor, a gear mechanism, and a piezoelectric device, and since the operating mode of a brake is divided into two stages of a low load large stroke portion and a high load smallness stroke portion and it enabled it to kick it in a brake, small lightweight-ization of a brake gear can be attained. Moreover, the responsibility of the brake pressure control by the gear mechanism and the piezoelectric device can improve, and control by the electronic control can realize an antiskid control, traction control, etc. easily further. The operation effect which was excellent in **** can be done so.

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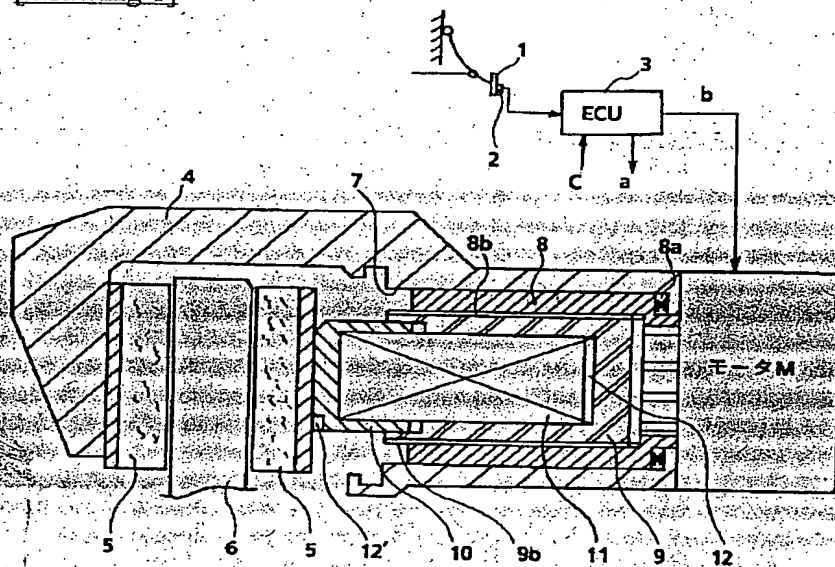
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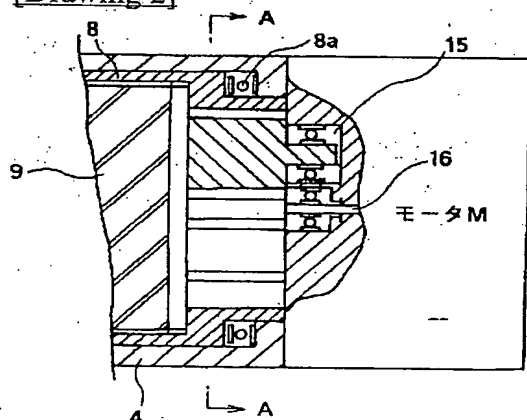
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DRAWINGS

[Drawing 1]

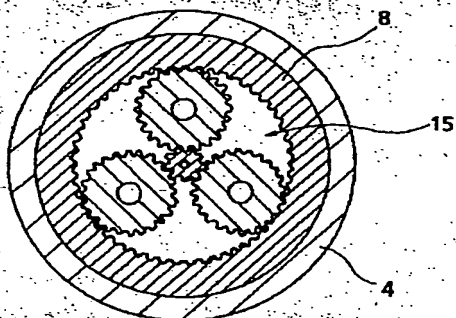


[Drawing 2]



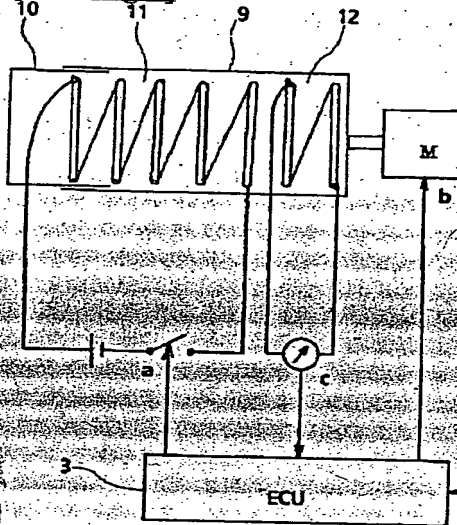
[Drawing 3]

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[Drawing 4]



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